

# Worksheet: Circuits & Ohm's Law

**Equations:**

Electric Potential =  $\frac{\text{electric potential energy}}{\text{amount of charge}}$       1 volt =  $\frac{1 \text{ joule}}{\text{coulomb}}$

**GENERAL EQUATIONS**

$I = \frac{V}{R}$       Current =  $\frac{\text{voltage}}{\text{resistance}}$       Amperes =  $\frac{\text{volts}}{\text{ohms}}$        $P = IV$

**SERIES CIRCUITS**

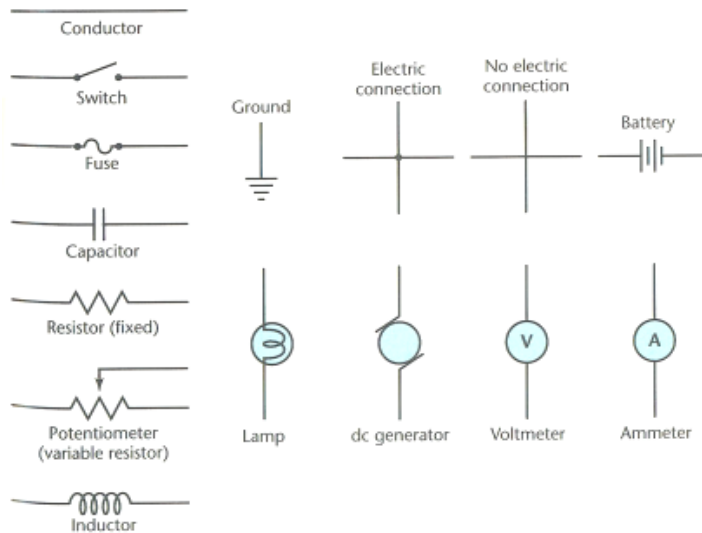
$I = \frac{V_s}{R}$        $R = R_A + R_B + \dots$        $V_s = V_1 + V_2 + V_3 + V_4 + \dots$

**PARALLEL CIRCUITS**

$I_A = \frac{V}{R_A}$        $I = I_A + I_B + I_C$        $\frac{1}{R} = \frac{1}{R_A} + \frac{1}{R_B} + \frac{1}{R_C}$

$V_s = V_1 = V_2 = V_3 = V_4 + \dots$

**ELECTRICAL CIRCUIT SYMBOLS**



**QUESTIONS:**

1. Draw a **circuit schematic** (diagram) to include a **50.0 V** battery, an **ammeter**, and a resistance of **10.0 Ω** in series.

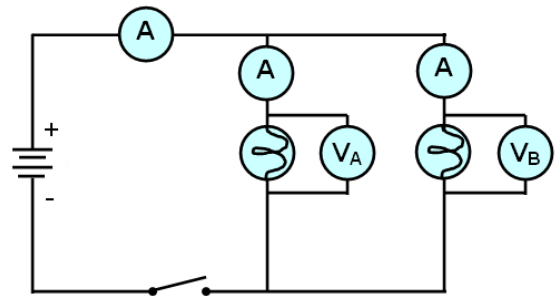
- a. What is the reading on the **ammeter**?
- b. In which **direction** is the **current** flowing?

2. How much **current** flows through a radio speaker that has a resistance of  $4.0\ \Omega$  when  $16\ \text{V}$  is impressed across the speaker?

3. Draw a **circuit diagram** of the circuit described in the question above. Include a  $6\ \text{V}$  battery, an **ammeter** (labeled with value of **current**), and a **resistance** of  $3.0\ \Omega$  (the speaker). Also label the direction of the conventional (+) current.

4. The following questions pertain to the circuit diagramed to the right.

a. **Lamp A** reads a voltage of  $12\ \text{V}$ . What is the voltage of **lamp B**?



b. If the ammeters on both branches read the same amount, what does this tell you about the **resistance** of the two branches?

c. If the current flowing in the first branch was  $4.0\ \text{A}$  and  $6.0\ \text{A}$  in the second branch, what would the **total current** in the circuit be?

5. Draw a series **circuit diagram** showing a  $6.0\ \text{V}$  battery, a **resistor**, & an **ammeter** reading of  $2.0\ \text{A}$ .

a. Label: the size of the resistor, the direction of conventional current, the (+) and (-) terminals of the battery.

b. Add a voltmeter to your diagram and indicate the **potential difference** across the resistor.

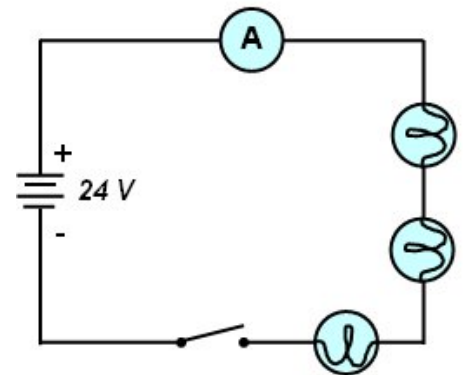
6. Draw a **circuit diagram** showing a heater with a resistance of  $6\ \Omega$ , and a potential difference source of  $24.0\ \text{V}$ .

a. Calculate the **current** through the resistance

b. What **thermal energy** is supplied by the heater in 10 seconds? (HINT- use the equation  $E = I^2Rt$  to determine energy)

7. Use the **circuit diagram** to the right to answer the following questions.

a. What is the **current** flowing through this series circuit if the total resistance is  $20\ \Omega$ ?



b. What would the **voltage** across each of the three bulbs be? What could you say about the **brightness** of each of the bulbs?

c. If two of the bulbs had a total resistance of  $15\ \Omega$ , what would the **resistance** of the third bulb be?

d. What would be the **current** flowing through the circuit be if the voltage source was  $6.0\ \text{V}$ , and each of the lamps had a resistance of  $2\ \Omega$ ?

8. Draw a **circuit diagram** showing three  $10\ \Omega$  resistors connected in parallel and placed across a  $60.0\ \text{V}$  battery.

a. What is the **equivalent resistance** of the parallel circuit?

b. What is the **current** through the **entire circuit**?

c. What is the **current** through each **branch** of the circuit?

9. Draw a **circuit diagram** showing the following: a  $800.0\ \Omega$  resistor, a  $40\ \Omega$  resistor, and a  $20\ \Omega$  resistor connected in parallel and connected across a  $24.0\ \text{V}$  battery.

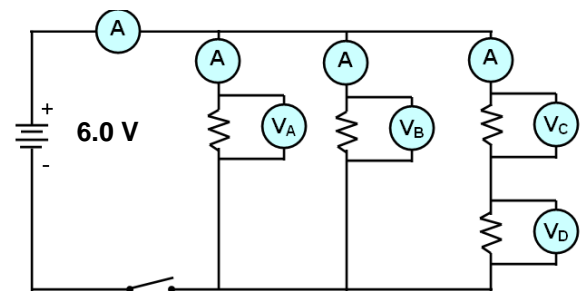
a. What is the **equivalent resistance** of the parallel circuit?

b. What is the **current** through the **entire circuit**?

c. What is the **current** through each **branch** of the circuit?

10. Answer the following questions about the circuit to the right.

a. What do each of the 4 **voltmeters** read?



b. If each of the resistors are identical, and the **total current** flowing through this parallel circuit is  $12.0\ \text{A}$ , what is the **total resistance** of this circuit?